DRAFTSMAN'S MANUAL

DRAFTSMAN'S MANUAL;

OR,

"HOW CAN I LEARN ARCHITECTURE?"

HINTS TO ENQUIRERS.

DIRECTIONS IN DRAFTSMANSHIP.

NEW REVISED AND ENLARGED

FOURTH EDITION.

BY

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INTRODUCTION.

HAVING frequently been asked, by wide-awake young carpenters and builders, how best to qualify themselves for practising the profession of Architecture, I have in the following pages set down the steps which to that class are necessary and expedient, in the order that they must be undertaken.

In the hope that what I here set forth may be found of use to such mechanics as are of inquiring minds in this direction, and that such as are of the right stuff may be encouraged and helped, I trust this little attempt to its public.

FRED'K T. CAMP,
Architect.

PRELIMINARY WORDS.

IN attempting to supply by these simple directions a want which has frequently been expressed to me, I will confine my scope strictly to a practical description of the methods in use for placing upon paper and other materials those somewhat mystic lines called plans, elevations, and sections—so often erroneously denominated Architecture when the word ought to be Draftsmanship.

The query generally runs, "I want to learn architecture;" a term often much broader than the real intention in the majority of instances, as the ambitious ones only mean that they want to learn how to make plans, sections, elevations, and details. They don't really want to go through the course necessary to thoroughly inform them as to the History of Architecture; the styles—classic, Gothic, and Renaissance: but they think that the draftsmanship necessary to enable them to draw plans, etc., of common, everyday city and country houses is *Architecture;* and so they want to "learn" it.

I have presumed in the foregoing that the real desire on the part of any inquirers is to learn *draftsmanship* and not *architecture;* and of the former I shall treat first, reserving the topic of architecture until the previous one of draftsmanship is disposed of.

DRAFTSMAN'S MANUAL.

DRAFTSMAN'S OUTFIT ENUMERATED.

Drawing-board, a convenient size, 24 x 36 inches.

Two T squares, one 24 inches and one 48 inches.

Three triangles, one each of angles $27\frac{1}{2}°$, 45°, 60°.

A dozen thumb tacks, preferably of German silver.

Pencils of varying hardness, say half a dozen, from No. 4 to 6 H, or corresponding numbers.

Rubber, not too hard, and close grained.

An ink slab and well of white earthenware or slate.

A set earthenware color saucers.

Half dozen camel's-hair brushes of different sizes.

Four cakes of colors—red, blue, brown, ochre—and as many others as are desired.

A stick of India-ink—the best is the cheapest.

Instruments—one pair plain $4\frac{1}{2}$-inch dividers; one large compass, fitted with pencil and pen legs; one small compass, fitted as before; two ruling pens, large and small; a foot-rule. These are necessaries. Most draftsmen have more instruments, gotten at times when specially needed, such as spring dividers, large and small; standard steel scales, comprising many divisions to the inch; proportional dividers, parallel rules; protractors; small fine compasses, both pencil and pen; crow-quill drawing-pen points, etc., etc. *

White paper comes either in sheets of different sizes, from small or ordinary to large or double elephant; or in rolls of 48 and 52 inches wide, and twenty or thirty yards in length; but a yard or so can be purchased at a time, and is more economical for general use, as pieces of any size can be cut from it, and there is less waste than when sheets of a uniform size are used for all purposes. It is not necessary to use white paper for any of the drawings unless they are to be nicely colored, or are for show; but a good grade of heavy light brown manilla paper will answer every purpose and be much cheaper. It comes in rolls only, but can be bought by the yard or pound. Tracing-cloth is a semi-transparent fabric, consisting of linen cloth, prepared with wax and turpentine in a manner that leaves one side with a high gloss and the reverse of a dull appearance. Some tracing cloths have

*See Appendix A.

both sides glazed, but the best have dull back. Opinions differ as to which side is best to put the ink on. If the tracing is to be colored the dull side takes colors best, though if the lines are on the dull side the reverse will take the colors, but with some difficulty ; but bear this in mind—always color on the reverse side from that on which the ink lines are. If this is not done the color brush will be sure to soften and spread the ink lines. When tracing-cloth has been kept in too dry a place, or is old, it becomes difficult to make the ink flow evenly on the smooth surface. In that case a minute quantity of ox-gall or soapsuds in the ink will cause this difficulty to disappear.

TECHNICS OF PLANNING.

Assuming the young man who wants directions in draftsmanship to be ordinarily well educated as to arithmetic, reading, writing, and spelling, and, above all, attentive and eager to learn, his own experience in carpentry or masonry enabling him to understand all the points about material, etc., puzzling to many beginners, he must first try to understand how the plans are intended to actually represent the building, at different stages of its construction. In general, the plans show the appearance of the walls, as if left with a horizontal face, cutting through the windows and doors at some point in their height—just where is immaterial.

It is customary to show all such openings, whether they would be in such an imaginary plane of section or not, leaving to the elevations or further drawings to show the heights, if irregular.

The drawings are usually made on a scale of four feet to one inch—familiarly called "quarter-inch scale," and some of large buildings on an eighth-inch scale, or eight feet to an inch. Elevations and sections should be on the same scale as the plans.

For instance, a plan of a base course would show a continuous wall (except where openings were to be left for passage of drains, etc.) of the necessary width—three feet, three feet and a half, etc.

The foundation or cellar wall would show solid, except where doors, windows, ventilating apertures, and the

like were to be, which would be indicated by lines, showing somewhat as a cross-section of the article in question would appear.

Piers, buttresses, stair bulkheads, and cisterns are shown by solid walls, colored. A general definition of the way to represent walls is: the two faces are lines, and the body of the wall is colored blue for stone, or brown, as may be the color of the stone to be used; red for brick; a reddish yellow ochre or orange color for wood; drab for slate courses; brown for black walnut, brown stone, etc., etc.

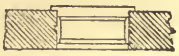


Fig. 1.

Fig. 2.

Fig. 1 represents the character of most of the windows put in cellar walls to light cellars. The outside double line is a winter sash and the inside one the common sash. The shaded part is stone wall. The window-frame is of plank, not boxed, and the sash are hinged or fastened in with buttons.

Fig. 2 shows how a window in a wall of a frame house is represented. The shaded part is the wall.

Fig. 3 represents a section of a window set in an eight inch brick wall. The shaded part is the wall, and the squares are the boxes. The furring, plastering, etc., are shown by the extra line on the wall, and the architrave or casing and sill are inside the window.

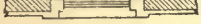


Fig. 3.

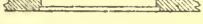


Fig. 4.

Fig. 4.—This example shows how to represent a double or single external door in a frame wall. The sill projects, as do all the others, and the shaded part is the mass of the wall.

Fig. 5 represents a section of a double or single door in the wall of a brick house. The wall is eight-inch, and is shaded. The frame, with fillet on the brick side, shows on the jambs, and the furring, lath, and plaster inside.

Fig. 6 shows the usual plan of steps and step buttresses, of either wood or stone. As a general form, it is well understood, but of course special designs in any of these illustrations given would alter more or less their forms.

Fig. 7.—This cut is of a wooden bay, projecting from a frame house-wall. The angle of the sides is 60° with the wall. The length of the sides is equal. The outside line is that of the sill. The dotted crossed lines and parallel ones

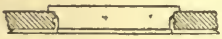


Fig. 5.

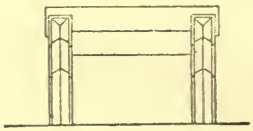


Fig. 6.

show that the opening into the bay is arched. The shaded parts represent the wall and angles.

Fig. 8 is also of a bay, but of brick attached to a brick wall. The angles are calculated of 4 and 8 inches to avoid cutting the brick, and the sides are recessed for the same reason. The shaded parts are of brick, and the clear parts are

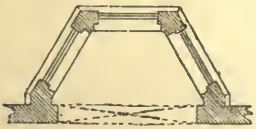


Fig. 7.

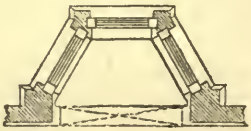


Fig. 8.

the box frames, furring for jambs of arch, wall, etc. The dotted lines represent arch as before given.

Fig. 9 shows how to represent a roof plan, to show the ridges, hips, valleys, chimneys, etc. The heavy black line inside the eaves, or cornice, is the position of the plate, or

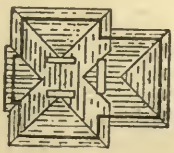


Fig. 9.

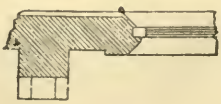


Fig. 10.

outside wall. The slopes are lined horizontally with the fall, and represent the lines or rows of slate or shingles.

Fig. 10 represents part of a church wall, showing a buttress, and half of a window. The jambs are seen at an angle,

instead of square with the wall; because generally windows in churches are so narrow that the splay is a necessity, to increase the number of entering rays of light. Not many church windows are made to slide like the ordinary ones, and yet the practice is on the increase.

Fig. 11 shows how a partition, showing the base, is represented. If base is not desired to be shown, omit the outer lines. The inner lines represent the plaster faces of the two sides of the wall, and the studding is 2 x 6 inches.

Fig. 11.

Fig. 12.

Fig. 13.

Fig. 12 is similar in all respects to the foregoing, except that it represents a partition where the studding is 2 x 4 inches.

Fig. 13 represents a pocket for sliding doors, and shows how the inside should be lined. The partition in which a set of sliding doors is placed must always be much thicker than an ordinary one, and, according to the thickness of the doors and the size of the studding, varies from eleven to fourteen inches between the plaster faces of the two sides of the wall.

Fig. 14 illustrates the way of showing a range placed in kitchens. The wall back of it is of studding, covered with sheathing and clapboards. Inside is the plastering and base. These divisions of the wall are not usually shown on scale drawings. The shaded part is brick.

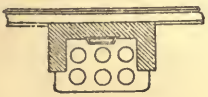


Fig. 14.

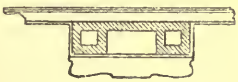


Fig. 15.

Fig. 15 shows section of a chimney in a wooden house, with a fireplace and mantel. The component parts of the wall, again, are not usually shown on scale drawings, but are given here to illustrate the construction.

Fig. 16 is a section, as usually constructed, of a chimney breast in an upper story—for instance, where no fireplace is desired. It shows the flues, both from below and on the floor, surrounded by a four-inch brick wall. Flues are gen-

erally called for to be pargetted—that is, plastered with a peculiar composition of mortar; but many prefer, instead of enforcing that clause, to have the joints perfectly filled with mortar, and the inside face struck flush, plastering the room side of the stack also, to prevent any spark from finding its way through. Thus done, four inches in dwelling-house chimneys—which is the usual thickness of their inside walls—is as good as eight inches if done in the usual careless manner of laying up general walling. The shaded parts are brick, the plastering, furring, etc., showing by an extra line inside.

Fig. 16.

Fig. 17 represents how a register in a wall is shown. The shaded part is the wall. Nice wall registers generally have a projecting front, though the majority of them are made flush, then appearing more like Fig. 19, which is a ventilating valve register. Registers in the floor, when used, which ought to be seldom, are shown by lines in an oblong figure, with crossed diameters, and the size in figures marked thereon.

Fig. 18 shows a hot-air flue in a wall. The flue supplies an upper part, but their location is oftentimes necessary to be determined in the floor below. All hot-air flues should be surrounded by iron lath throughout their passage, and the

Fig. 17.

Fig. 18.

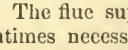


Fig. 19.

flue itself and the register-box in the best work are made double, with an inch of space between inner and outer skins, thus reducing the chances of a conflagration from an overheated furnace to a minimum. The shaded parts are the surrounding wall.

Fig. 19 illustrates the method of indicating on a plan a ventilating flue. The shaded part is a brick wall, and the flue is a notch or jog 4 x 8 inches. At every opening, where the flue communicates with the room, is placed some form of register controlling the flow of air. In wooden walls a flue of wood or tin should be used.

Fig. 20 illustrates the usual way of showing a hot-air furnace in a cellar. The walls are of eight-inch brick, and in the centre are shown the grate, fire-pot, and door-way.

The usual dimensions needed for these furnaces are from 6 x 6 feet to 8 x 8 feet. When steam is the heating agent, make the brickwork slightly oblong, and omit the central circular fire-pot, etc. In actual plans sometimes it serves a purpose to mark the location of the hot-air flues, as they radiate from the crown of the furnace.

Fig. 21.—Here is shown an end or side of a bath-room, some eight feet or nine in length, accommodating a bath-tub and seat. The two are usually in close juxtaposition, as the

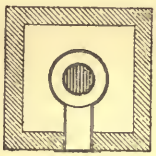


Fig. 20.

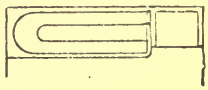


Fig. 21.

waste pipe of the bath-tub discharges into the soil-pipe, and the nearer it is the less costly is the plumbing. The tub is of the dimensions usually of 2 feet 3 inches wide by 6 feet long. A seat may be 20 inches wide by 28 inches long.

Fig. 22 is a corner wash-stand, piped for hot and cold water, and placed in locations where there is no room to spare. Bath-rooms are usually supplied with either one form or another of wash-basin; though if there are others in the chambers, one in the bath-room is not so necessary.

Fig. 22.

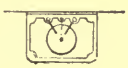


Fig. 23.

Fig. 23 is a variation in form from the preceding one, and is used where there is plenty of room. It is a set wash-basin attached to the wall by one side only, and is a little more costly than the corner style shown above.

Fig. 24 is the form usually given to a sink and surrounding shelf. Where there is a cistern to draw from, a pump is rightly placed as shown. A handy adjunct on the left is a drainer, a cross-barred grating above a slanting surface, draining whatever drips from or upon it into the sink. It is

now more generally not cased up underneath, as continual moisture and darkness caused rot and allowed unseen dirt. Open under it is easily kept clean.

Fig. 25 illustrates the top of a set of three tubs, as they are put into kitchens and laundries. The dotted lines show the shape inside, shelving forward and under. Each tub has a lid of its own. The size of each tub ought to approximate 22 inches wide by 28 inches long, measured inside. The depth may be sixteen inches. The plumbing consists in a hot and

Fig. 24.

Fig. 25.

cold water faucet for each tub, where there is a boiler connected with the range—only cold, when no boiler—and a waste-pipe, plug and chain, all of brass. These pipes should not be put in cold situations, and the tubs should be set on legs, up from the floor, so it can be scrubbed. The tubs are made of two-inch white pine clear plank, dadoed, and the joints fitted accurately and painted with thick white-lead before put together.

Fig. 26 shows the construction of a cupboard. The shaded parts are the inclosing sides and the supporting partitions. The shelves run through, and are about a foot wide. The

Fig. 26.

Fig. 27.

upper doors are panelled either in wood or glass. Under the broad shelf are drawers, or a larger cupboard. These are built in pantries, store-rooms, and kitchens.

Fig. 27 represents a cistern tank. Such are usually put in upper stories, and, supplied by either a force-pump or rain-water from the roof, form the source whence the boiler and the other outlets are fed. It is made, like the tubs, of heavy plank, size about 3 x 4 x 2 feet, the ends projecting and clamped by iron rods.

Fig. 28.—This cut shows the lower end of a flight of stairs. The narrow double lines are the wall—the last three steps are bowed out. On the side opposite the wall stands the newel, to which is attached the rail, which in turn is supported by balusters. The turning out at the foot of the rail as it meets the newel is usual where there is room, but in a narrow hall there would be only a straight line on the face string. The lines from rail to wall string are the faces of the risers, and in the upper steps are only dotted in, so that any constructions under the stairs may be shown in full black lines.

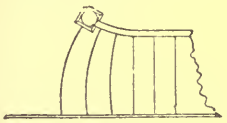


Fig. 28.

Fig. 29 shows the manner of representing gas chandeliers. The left-hand one is a four-light, the next three-light, the next two-light, the next a hall drop-light, and the next a

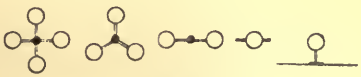


Fig. 29.

single bracket projecting from the wall. In place of the large circles, sometimes little stars are made for a flame. The circles stand for the globes.

Fig. 30 illustrates the manner of putting a niche in a corner —at the upper end of a staircase, for instance. It has generally a rule-joint edge, or a bead, and the slab, of marble, at the bottom is made to project enough to receive it, with a good finish.

Fig. 30.

Fig. 31.

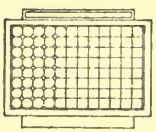


Fig. 32.

Fig. 31 is a niche in a square corner, such as in apartments or the end of halls opposite the stairs. It may be finished like the other, and also with a marble slab at the bottom.

Fig. 32 gives a representation of a common form of tiled hall or vestibule, the projections seen at top and bottom being

at the sills of the double doors. These sills ought to be marble or slate; then a course of chocolate-colored plain tiles and other brighter-colored ones making a pattern towards the centre. Borders should be in plain, solid colors, no matter how lively the pattern in the centre may be.

Fig. 33.—We show here the same shape of vestibule covered with a marquetry floor, of vari-colored woods—black walnut, mahogany, tulip, cherry, etc. In a hall-way the border runs around the stairs, so that the pattern is at all points inclosed in a border.

Fig. 34.—Here is represented an example in the framing plans of floors, etc. When a chimney or other opening through a floor is made necessary, double the beams on each side, and put across, securely mortised and tenoned, a header of the same section as the doubled trimmers. The shaded parts stand for a brick wall and chimney. If the opening is a stairway, trap-door, or for flues or pipes, domes or sky-

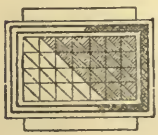


Fig. 33.

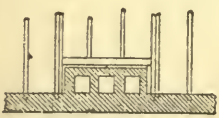


Fig. 34.

Fig. 35.

lights, the method is the same; but the timbers, unless directly supported from below, must be carefully proportioned to bear the weight, cutting, etc.

Fig. 35.—In stores, banks, etc., are often constructed fire-proof vaults, of no remarkable size perhaps, but of great use and importance, and at a cost not exceeding a good safe, though providing much better and roomier space. Build on a solid or nearly solid foundation two eight-inch walls, with an air space between them of from two to four inches, and the tying brick irregularly but frequently interspersed. The corners should be solid, as shown, and so also the door jambs. The doors and frames are made by iron-workers, and are set up, plumbed, and built in as the work proceeds. The floor may be tiled, or bricked and cemented. The mortar should be one quarter cement. When the requisite height has been reached, the roof may be made in several different ways, either arched, with tie-rods buried in the

material, or with iron beams stretched across the shortest diameter, and brick laid in mortar between, for a foot in depth. Then plaster the sides as on any room wall. The vault, if in a high story, may be made with a second one on top, or in a large office building, carried up through, giving a vault on each floor.

Fig. 36.—In this figure we give one of the commonest forms of store fronts. The girder carrying the front wall of the superstructure is supported by the two iron columns to-

Fig. 36.

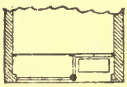


Fig. 37.

wards the centre. Doors recessed, and in front of them a vault light in the floor (see Figs. 38 and 39). Variations of this form are to bring the show-windows forward like bay-windows, or to have the jamb or narrow side-lights at a different angle from the right angle. When the girder above is a compound cast and wrought segment, there need be no columns in the front at all, and the doors and show-windows may be altered at any time without disturbing the girder and front of building above.

Fig. 38.

Fig. 39.

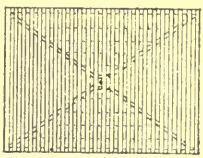


Fig. 40.

Fig. 37 is a representation of a smaller or narrower front than the preceding. Here, after the necessary width for the doors is taken out, all the rest should be given to the show-window. If more symmetry is desired, place the column in the centre, and slant the jamb light to the door frame. A vault light is placed in front of the doors. The shaded parts are brick walls.

Fig. 38 shows a vault or floor light, used to light cellars, etc., and placed in the floors of stores to transmit the light

below. It is made of a cast-iron frame with cross bars, rebated, and the squares of glass are from three quarters of an inch to one and a quarter inch thick, joined accurately at the top edges, and set in cement or putty, so that they are water-tight. Any number of frames can be joined together to make a large light space, but a single frame is not usually larger than 3 x 4 feet.

Fig. 39.—This vault light is for outside use, in side-walks, in that portion next to the house or store, and consists of a cast-iron frame as before, but instead of the cross-bars small holes two and a half inches diameter are left, into which are cemented bull's eyes of glass, the whole of the joints afterwards made tight by painting with tar. Round vault lights of the same description are made to set in the sidewalk, to light large vaults built under it.

Fig. 40.—This cut shows the construction of a wooden washing floor in a stable, or more properly, carriage house. The top, level with the surrounding plank floor, is formed of

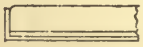


Fig. 41.

Fig. 42.

stout bars of wood, two inches square, properly supported, and about two inches apart. The diagonal diameters are timbers, rebated to receive a planking, and inclined four to six inches toward the centre to form a drip converging into the waste-pipe there placed. A washing floor can be constructed in other materials, stone or brick, on the same principle, by making the inclination less, say two inches, and omitting the grating. A screener should be placed over the waste to keep the pipe from being clogged by straws, chips, etc.

Fig. 41 shows how to draw pews in a church. The distance from back to back varies according to the number desired to accommodate. For instance, if at three feet apart (a roomy dimension), a certain number can be seated, and more are desired, place them two feet ten inches, and a score or two will be added to the seating capacity.

Fig. 42 is a mode of drawing desks and seats in school-rooms. Some desks are only single. Aisles between every

desk, from 24 to 36 inches wide. Some desks have seats combined in front, but separate seats are more desirable.

Stucco cornices, in angles between ceiling and wall, are sometimes shown on plans by a dotted line around the walls of the room. These cornices must follow every break in the walls, and are drawn the required width on the scale, and have figures on them to mark the vertical dimension. Centre-pieces, also, are lightly dotted in, to show the shape, whether round, oval, or lozenge. Some attics or French roof stories have the roof-side walls furred vertical, leaving an air space next to the roof. This is shown on plans by a thin partition, drawn some distance inside of the walls, as much as is necessary to give the vertical wall the desired height.

On plans for churches, stores, schools, and other buildings devoted to special uses, there are many more kinds of representations. The doors, for public use, in buildings where there are numbers congregated together should be hung so as to swing outward.

GENERAL REMARKS ON PLANNING.

The first plan generally drawn is the most important one—be it the first or second floor, and regard must be constantly had in the mind as to what goes above and below it. The manner of roofing particularly must be consulted at every angle, in order that the gables shall not all be different widths and heights, or of diverse pitch.

So, too, the location of windows and doors must be determined with reference to the building, as a whole, conceived in the mind, rather than the apparent wants of the first floor only. So if windows are properly placed in the stories below, the designer when he comes to the elevations will rarely be troubled with the vexation of finding that a raking cornice cuts his intended dormer in two, or his roof so crowded with gables and gablets, hips and valleys, as to make it an expensive affair to construct and keep tight.

There are empirical rules for regulating the size of windows so as to admit the supply of light necessary to fully satisfy the requirements of the room, but as that calculation is rarely necessary, except in the larger structures, such as exchanges, churches, schools, etc., I will only say here that common-sense should teach any clear-headed designer of ordinary dwellings the number and size of the windows neces

sary to light the rooms and halls in his plan. Usually windows in each story are of uniform height, if not width ; but that is not absolutely necessary. Pantries, closets, bath-rooms, dressing-rooms, stair-halls, and attics may all have windows differing in shape and size from the rest in each story, and, judiciously combined with the other features of the elevation, they add to its appearance, and indicate their uses. The designer cannot expend too much thought upon the number and position of his windows and doors with reference to the size of the room, what it is to be used for, and the pieces of furniture it is to contain.

It may seem superfluous to speak of such an obvious duty, but it is one nevertheless which is but too often slackly performed, and the result is a bad-looking, inconvenient set of rooms. A parlor should always have one, if not two places where a piano could be placed against a wall far from the sources of heat. A sideboard should be thoughtfully provided for in a dining-room, a large table in a kitchen, and one place certainly, better two, for a bed in every chamber. Also gas brackets should be so arranged as to light a dressing-case, even when it is in a good position for receiving daylight.

In planning a first floor it is desirable, if it can be done, to face the house at one of the four midway points of the compass, such as north-east, north-west, south-east, or south-west. Thus all the rooms are sure, at some portion of the day, to receive sunlight, more or less. Where such a position for the house is impossible, try and make the dining-room face the eastward, or have some windows letting in east light, or if the house is a large one, the breakfast-room might be so placed, and the dining-room be on the west. A sitting-room is pleasant if it faces the south. A kitchen may face the north, as from its heated condition it protects the rest of the house from the cold of that quarter.

In general the living rooms should be so situated as to receive the sun. Water-pipes to set-bowls, bath-tubs, wash-tubs, sinks, and tanks should be run in sheltered situations, care being taken to put them next to chimneys, or in interior partitions, never on outside walls, unless carefully protected and boxed.

Whatever the direction in which the rooms may be made to face (which with most houses is not a mooted point), the interior arrangement of them is more amenable to circumstances. It is desirable to have the entrance so placed as to

be readily discernible from the outside, sheltered by a porch or else a vestibule with its outer and inner set of doors.

The hall to which these doors give access should be roomy near them, and the stairs, if possible, placed in a subordinate passage. Folding or sliding doors to the parlor from such a hall are suitable, but if the stairs are necessarily put near the front door it is sometimes possible to start them at the rear end of the hall, and give the run forward, cutting off the last three or four upper steps by an arch, thus making a clear space near the front door.

But often the old arrangement is best, especially where the front stairs are the only ones in a house, and a cellar flight must be under them; though even then a wide close flight might lead from a small hall near the front door and answer all purposes.

It is generally wished that the front door may be attended to by the servant without necessitating a passing through a room, as the dining or sitting room; but in contracted cases, either in lot or purse, that cannot always be accomplished.

The back parlor, or sitting-room, library and chamber, if there is one on the first floor, should open from a hall, either front or rear. A chamber may open from the sitting-room, but it is not to be desired, as the utmost ease of access with possible privacy should be sought after, with all approaches to bedrooms. Such is always best attained by a hall.

The pantries and china closets should be so situated that they are on the coldest side of the house, or between the kitchen and dining-room, so as to shut off the odors of cooking. A laundry, if only little more than large enough to hold the tubs, is very desirable, to take Monday's slop out of the kitchen, and should open from that room. *

GENERAL REMARKS ON EXTERIORS.

Coal and wood sheds are now nearly obsolete, and those materials are stored in the cellar, access to which ought to be convenient under the back stairs—the door to the cellar opening out of the kitchen, or from a passage but a step or so further. But sometimes a small shed may be inclosed from part of a veranda, running alongside of the kitchen, and the house be no worse in looks for it.

Verandas should be on the sunny sides of a house, and should not be too freely used unless the climate is one which

*See Appendix B.

demands their use. Bay-windows are generally good features, if not too numerous. They may best be used to catch a desired view, or to enlarge a small room ; unless quite large they should not extend above the first floor. The shapes vary, but it is more dignified not to use many, or more than two, forms on the same house. One form of bay has been illustrated, and is a very good one for general use. Then there are bays of a square-angled form, and those whose sides are at an angle of 45°, having the three sides equal, or the second side the longest. Bays of a **V** shape are capricious, and do not contain much room, and those of a segment or semicircular form are good looking, but are apt to be expensive in execution.

There are various ways of finishing their roofs, but the most usual way is to make it similar to the veranda roofs near by.

Interiorly the opening into the bay is usually arched, or with a straight lintel, supported by corbels ; but, if the ceiling of the bay is on the same level as that of the room, there is no need of an arch, but the cornice of the room may, if not too large, be run into the bay, and around its angles.

The chief reasons for having a dividing line at the ceiling between the bay and the room are, the difference in level sometimes, and the difficulty of taking a large cornice into a bay much too small for it. The bay, if separated from the room by an arch, should always be corniced with a small pattern.

Oriel windows are bays on upper stories, and usually project from the walls, supported by brackets, trusses, or consoles ; and the same remarks will apply to them as were written about bays, except that they are more rarely used, on account of a rather unwieldy appearance and difficulty of management, except on large constructions.

When designing gables, it is necessary to observe caution in their disposal, so as not to have two immediately together ; for the old-fashioned **M** roof is no longer considered stylish, and never was beautiful. Gables may vary slightly in their pitch from each other, as a little difference is not readily noticed ; but too much contrast is to be avoided, if the dwelling is desired to have a finished, well-studied effect. Gables and ridges should have the same heights, or pretty considerable difference the one from the other—that is, it generally looks better to have a subordinate gable some feet lower than

the principal one, rather than to come within a few inches of it.

In houses with a plan approaching a square, it will often happen that there will be a deck at the junction of the ridges of the gables, if they are of equal height; and where a deck is likely to occur, the gables had better be kept at a uniform width, pitch, and height. But in a very long plan care for the above is not so necessary, as the deck is unlikely to be formed.

Pediments are mere ornaments, and much might be said to prove that they ought not to be used, except in a very moderate way, on cornices where the roof is low-pitched. In the formal classic styles, as they are now used, under the rules of the Renaissance, pediments are more in vogue over windows, doors, pavilions, etc., than in the more ordinary designs of every-day practice.

The chimneys should be so located on the plans that when they are topped out above the roof they will not be overshadowed by any part of it, and therefore chimneys generally should not be placed in the outside walls of any house which has a steep-pitched roof. A certain boldness of style may indeed carry off well the tall, spire-like stack, when rising far to clear an impending ridge; but the boldness must not be confined to the one part only, and hence, unless the whole design is treated alike, one part ought not to have such undue prominence. Besides, there is danger to both roof and chimney from snows and storms. A reason, aside from those given above, why chimneys should be planned on inside walls, is that one stack accommodates more rooms, and the heat is better retained, and thus the house is economical; also, the design is rendered more symmetrical by having the chimney-tops—the highest parts, as a rule—grouped in the centre.

Towers and cupolas are of individual taste and preference. Some clients think a couple of hundred dollars well spent in such a finish, no matter whether either tower or cupola is ever visited for the sake of the view, or whether there is any view to try and see. Common-sense would, it seems to me, decide at once whether a tower or cupola, aside from the cost, were necessary to a house or not.

A word about gutters in main cornices. Of course, in bay-windows, porches, and small protections to openings, gutters must be used to some extent, but in main cornices it would

be well to try and avoid them; because, at least in climates inclement during half the year, the ice forming in them is apt to crack and tear the lining, dam up the opening to the conductor, and scale the paint in all places where icicles form, to say nothing of the actual danger attending the falling of large masses of ice in melting weather. Leaks in gutters conduct the water directly to the interior of the house, and are among the most troublesome of the annoyances a roof can inflict, being in the same category with the celebrated leaky roof of the Irishman, whose excuse for not mending it was that when it was fine it didn't need mending, and when it rained he couldn't.

On flat and deck roofs gutters may be avoided by framing the deck exactly like a washing floor, in a carriage house, before described, and taking the conductor down near a constantly used chimney. This conductor should be of iron or earthenware, and built into a jog in the brickwork of the chimney. Then the rush of water will make no noise, and the outlet at the roof will never be frozen up, the moist air from the cellar rising through it keeping off the formation of ice; and, last, there will be no icicles forming on the cornice. In the case of roofs with a pitch they should be so planned that the slope will be great enough to slide off the snow before it can accumulate, and the doors in the first floor must not be in the sides where the fall would be; or else in the cornice a gablet may be used over the door to divide the masses, so as to shelter the place where the door is. Low-pitched roofs, and some of greater pitch too, are provided with gutters put on a foot or so above the crown mould supported by small braces. A light iron railing is often put on the slope of roofs, in the same position, to arrest falling masses of snow and ice.

DRAWING THE PLAN.

The foregoing instructions and illustrations as to the parts of a plan being borne in mind, the learner may now essay to draw the plan of a house. For the first we will suppose an easy plan—say, three rooms on each floor. The house to be frame, resting on a stone foundation; the main part gabled, and also the rear part, but lower. The cottage is to be for refined occupants, who desire front and rear stairs, large pantry and china closet room, rooms of liberal size, and the ex-

terior plain, neat, but in keeping with the scale within doors.

The object of this plan is, to show the student how to combine the parts of plans which have been illustrated before, so we will suppose a simple cottage, but one in which we can show most of the parts brought together as they naturally would be. Let the kitchen be on the north side, flanked on the west by the laundry and pantries. Dining-room on the west, hall in centre, and parlor on the east. The south exposure protected by a veranda. The laundry is small, as before spoken of; and a passage connects dining-room with kitchen and hall, and separates it from both, to their manifect advantage. Over the kitchen is a room for the servant, furred off for trunk and other closets at the sides, and reached by a rear stairs as well as by a front flight. Over the other two rooms are chambers, spacious and of good height, with closets. A bath-room is in the rear part, handy to the water supplies. The cellar extends under the whole house, and is reached from the outside by a flight of stone steps, and from the kitchen by a flight under the rear stairs. From the copious descriptions hitherto given, the parts need not be described here in detail, but it is sufficient if the learner recognize them in their relative positions.

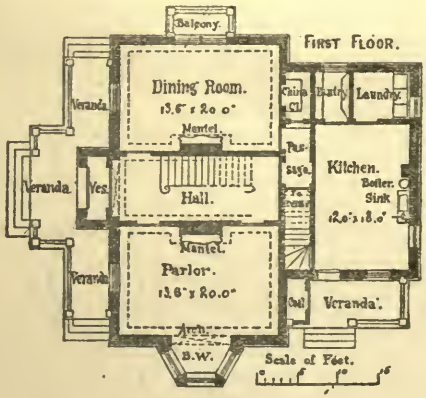
Points to be remembered in laying out the second floor plan are: As to the stairs, to be sure and give head room enough—six feet and a half to eight feet is the range of the requirements; get bath-room as near over the boiler in kitchen as possible, and easy of access from hall and bedrooms; hall is to be as well-lighted as possible, never to be dark in daytime, even with all doors closed; chimneys passing through rooms to have a flue devoted to the use of that room, and connected with it by a thimble in flue; cellar windows should be double—that is, a swinging sash inside, for use during the mild and hot months, and another sash in the rebate on the outside, to put in during severe weather.

USING THE INSTRUMENTS.

The mere drawing of the lines on the paper, guided by the T square and triangles, is simple.

Procure a board, with straight edges and square corners, and with four thumb tacks, secure to it a sheet of paper, about 18 x 24 inches. Holding in the left hand, lightly but

firmly, the stock, or cross-piece of the T square, as it rests on the board, with the stock on and up to the left edge of the board, slide it to or from you according to the position of the lines, and all the lateral lines, or those from side to side, may be made. For the vertical ones take a triangle, place one side on the top edge of the blade of the square, and with the fingers of the left hand so hold the triangle that the vertical or oblique lines may be made, sliding it to right or left as needed, and never forgetting to keep the lower part of the palm of the left hand on the blade of the square, always exercising a gentle pressure to keep the stock up to the edge of

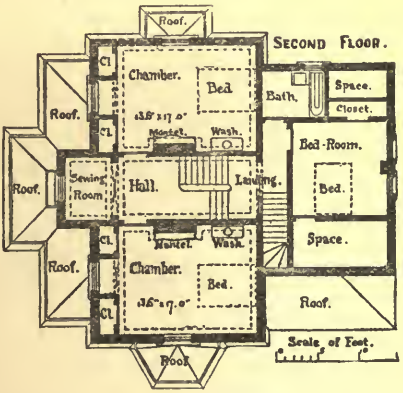


the board, so that the square and triangles will be sure to work true. Circles and regular curves are made by pencil compass; and care must be taken by him who would become a neat draftsman not to press the point in too hard, and to move the right hand, in which the compass is held, in a slight circle, to keep the pencil point touching the paper, but not too hard, lest the pencil take the place of the pivot point, and out comes the point and scrape goes the pencil, to the great disgust of the draftsman. After the first-floor plan is delineated, many designers proceed to draw the elevations. The upper floors are comparatively easy, and so is the cellar. Thus the same process with square and triangle is with them to be repeated—indeed, these two instruments are in constant action.

DESIGNING THE ELEVATIONS.

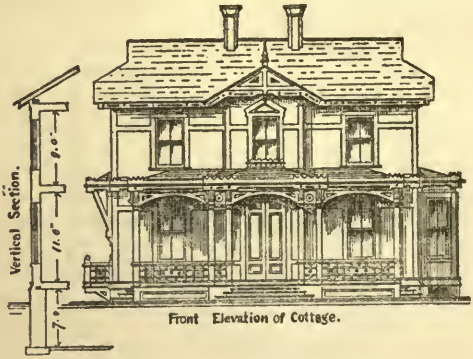
As previously directed, the style of the roof should have been studied at the time of planning the first floor, so that, if a gable roof is intended, the widths, pitch, and consequent height of ridge will come out right.

If a level cornice hip roof or a French roof be designed, the breaks in the walls may be less carefully arranged. Following our intended programme, we will make the main part with a gable roof, running from side to side, and a gablet over projection in centre. The rear is also gabled, but lower than the main part.



Fix a piece of paper, as before, large enough to take the intended design, and, leaving room enough at the bottom for lettering, and extending the cellar walls below the grade, draw the ground line, running the pencil along the top edge of the square nearly across the paper. Then determine the height above the ground the first floor is to be. It varies from two feet, about the lowest, to four feet, except in peculiar circumstances, when it must be placed accordingly. Draw another line at this point, parallel to the first. Then at the side or margin of the paper draw two parallel vertical lines, using the triangle, as far apart as the thickness of the

projected wall. This is to represent a section of the wall, and the floor lines must be run from it just far enough to show what they are. Next determine how high you want the first and second stories, and mark the ceiling of the first story on the wall, and draw the line out. One foot above this line, mark and draw out another, representing the top of the second floor. The same done higher up on the wall will determine the height of the second story. As the cottage we are drawing has no third story, this is as far up as we shall go. Beginning again at the first floor, measure down from its under side from six and a half to seven and a half feet, and draw a line there parallel with the other floor lines. This is the top of the cellar floor.



The thickness is according to circumstances; as for instance, if of brick, laid in sand, two and a half inches will be the distance from the top line to the lower one, denoting the thickness of the floor. If of broken stone, finished with cement, from six to eight inches will be the requisite thickness.

The wall shown above is of one thickness from the first floor to the plate; below the first floor it is of stone, twenty or twenty-four inches thick, down to the cellar floor, at and under which, from eight to sixteen inches thick, it widens to a footing course, six inches wider each side of the net cellar walls.

The plate is the bearing beam, at the top of the wall, where

the rafters rest ; and its height above or below the ceiling of the second story is determined solely by the taste of the designer ; sometimes forming a broad frieze, and having the cornice high above the second story windows, and sometimes bringing down the cornice till it overhangs and shades the window heads, or they are broken up through it. This design shows a medium height, and not too great projection of rafters. The pitch of the rafters too is a point left entirely to the designer, though circumstances sometimes point out whether a roof should be steep or low-pitched. When we have determined these points on our marginal sketch, the first floor plan is placed above where the elevation is to be drawn, and fastened there, with the front downwards. Then draw light lines down vertically from the corners and openings, or, better, to avoid marking up the paper too much, place the stock of the square at the bottom edge of the board, with the tongue pointing vertically, instead of horizontally, as before ; and, just bringing the edge right or left to the point desired on the plan, make a mark on the sheet where the elevation is to be drawn—the corner lines may be struck up long, and the window marks shorter.

Then replace the square so as to work it on the left side of the board, and draw horizontal lines from the marginal figure, called the section—first at the cornice, giving a line for every member next the frieze, and then below that for the heads and sills of the windows. These last are placed on the section by the following rules :

Sills should vary from twenty to thirty inches high from the floor, and the heads of windows should be a foot to two feet from the ceilings. Veranda cornices are best placed at the same line as that forming the top of the second floor, and their cornices and finish under in smaller proportion, but resembling the main cornice. These outside features being so much more variable in appearance, at the will of the designer, it would take too much space to illustrate them more at length than is done here, nor would it be profitable, as no two houses are ever designed alike. The most usual division of lights to a sash is now four to an opening, or two lights to the upper and two to the lower sash. A fine appearance is gained by having only two lights to an opening, or one to each sash, but when used it must be in an appropriate situation—not, for instance, in a thousand-dollar cottage.

Plate glass must always be used in as large lights as possible, not divided as sheet-glass may be.

Front doors usually have figured or embossed glass in the upper panels. If there are two sets of doors, the outside set has glass in the small top panels, and the inside set in the long upper panels.

It will readily be seen from the foregoing that the object of these pages has been to teach or show the learner how to represent on paper those parts of the *plans* of houses which do not vary much; the same could not be done with external features, as they vary, not only with every designer, but in every elevation that every designer makes. With practice will come facility and the representation of many things not here shown—original perhaps with him who makes them.

As for the elevations, their component forms are much less arbitrary than those of the plans; hence the desirability—nay, the necessity rather—of leaving the further discussion of them to each reader, who will be, it is hoped, also a student.

TRACING AND INKING.

These operations are simply mechanical, but require a light, steady touch, and care in handling the instruments.

After drawing in pencil some time, and being accustomed to sliding the square and triangles around over lines just made, it requires constant thought to avoid doing the same when inking over on the same paper the pencil lines which are drawn; or when putting the ink on the tracing-cloth, through which can be seen the pencil or ink lines on the paper underneath.

Commence operations by rubbing up the ink. Pure water is good, and so is vinegar. Put a small quantity in the well, in the end of the ink slab—not two thirds full—and taking the stick of ink, dip it in the liquid every three or four rubs, until it is perfectly black. That point can be readily ascertained by trying it with a pen on white paper. When dry it will show if black enough.

Fill now the compass pen, and after wiping off the superfluous ink, graduate the thickness of the line, and make first on the inking or tracing all circles or parts of circles. Usually when the last of these are done the first completed are dry. Always commence at the upper edge, that farthest from you. When done with any inking instrument always wipe it

thoroughly, which prevents the thick ink from drying on it, and rendering it unfit for a second use, until it is cleaned at cost of some time spent. Then, filling the ruling pen, move the square up until the top edge coincides with the highest horizontal line, and carefully draw over it, spreading the ink as you go.

The pen needs to be held upright, both nibs touching the paper or cloth. Always move the square down *from* the wet ink lines, remembering that if the square touches them a brushy-looking smudge is the result, hard to remedy.

When all the horizontal lines are inked and dry, then the vertical ones may be attempted. Take a triangle, place it upon the top edge of the square, hold it with the left hand, so the vertical edge will be on the right. Keep the square stock up to the edge of the board by pressure with the left palm, and draw the ink lines from up, down, along the vertical edge of the triangle. With lines at other angles the process is the same, always keeping the square as a base upon which the triangle slides up to the edge of the board. Finish by making the little connecting irregular lines, such as cornice profiles, cut work, etc., with a fine writing pen, making all joinings neatly.

This completes the process of outlining. A nicer appearance is given to both plans and elevations by shading. A heavy line is placed on the side of walls, cupboards, sinks, corner boards, window and door frames, eaves, posts, etc., opposite to that from which the light is supposed to come—presumedly the upper left-hand corner, though any other point might as well be taken. Shading and graduated shadows are likewise put on white paper drawings, not tracings, with a brush and washes of India-ink.

The lightest tints are put on first, and succeeding darker ones up to the part in deepest shade, and the edge of each one, while yet wet, worked off to blend with the next lighter, with a clean brush, wet in clear water. A piece of blotting paper, held in the left hand, and often applied to the spots of color left where the brush stops, will greatly assist in preserving an even tone. The shadows on rounded objects have two lights, one high light on the side of the direct illumination, and one on the opposite side, lower in tone, from reflected light.

The last process before the coloring is figuring the scale drawings. Each sheet must have the scale marked on it, and in addition parts where care must be exercised-

pretty generally all the parts—such as thickness of walls, sizes of doors, sash, posts, studding, joists, distances between floors, etc., etc., are carefully figured.

Plans must have the figures giving the length of sides to correspond or tally, and sections must give height of stories, size of joists, studding, projection of rafters, etc. There cannot be too much figuring done, unless the plan would become confused by so many dimensions being placed upon it. It is safe to say, give all the important ones and as many of the minor ones as possible. Besides, it makes the drawing of the full-size details much easier and more reliable.

In coloring both paper drawings and tracings great care is necessary to get the volume of tint even, and not of greater intensity in one spot than another. Use a pretty full brush, and stir the color about every brushful; spread the brush so as to fill all the space to be colored if possible, and where the brush leaves off blot up the quantity left unspread with a clean piece of blotting paper. When about to color inked drawings on paper, be sure and clean it off thoroughly before beginning, and use fresh made ink; then the lines will not spread.

THE ARCHITECT.

A PROFESSOR OF ARCHITECTURE, OR THE ART OF BUILDING.

In discussing the first part of my title, I hope to make it plain who can and who ought to be holders of the above appellation; for there are many in the ranks of the building trades who from their experience and knowledge can correct many a one called architect on important rules of practice. These, if they would study proportion, the styles, and the history of architecture, can become, truly speaking, architects. And, conversely, there are many who write "Architect" after their names who know nothing but how to make marks on paper which could not be built, or to copy other men's work.

These ought not to swell the lists of the profession, and would be better employed in being draftsmen simply, or by going to work at the practical part of architecture, "the art of building," and so correcting from experience their former errors of ignorance.

Those who ought to be architects are born with more or less aptitude for kindred occupations, and in boyhood are

noted for constructive ability and early liking for practising the delineation of objects of mechanical construction. They hang with unabating interest about buildings, and, as soon as old enough, if wisely guided, will learn regularly the operative carpentry or masonry which so delights them. After a few years' of intelligent labor, and while still young, a course of draftsmanship in an architect's office will prepare such an one finally for the expression of his conceptions, and, during this period, he should master the use of the following drawing instruments: rulers, ordinary and parallel, ruling pen, compasses, with pen and pencil, bow-sweeps, as well as the construction and use of simple scales, such as 1, 2, 4 or more feet to the inch, showing inches; or such as $\frac{1}{2}$, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{3}{5}$, $\frac{5}{8}$, or other fraction of full size, or of any given scale or drawing; and the meaning of such terms as plan, elevation (front, back, or side), section, or sectional elevation.

He should understand the object of bond in brick work, *i. e.*, English bond, Flemish bond, or English bond with Flemish facing, secret bond, and how it is attained in walls up to three bricks thick, in the following instances, viz.: footings with off-sets, angles of buildings, connection of external and internal walls, window and door openings with reveals and square jambs, external gauged arches (camber, segmental, and semi-circular), internal discharging arches over lintels, and inverted arches.

He should know where to put wood, bricks or plugging, and their use, the construction and uses of brick corbelling, and the construction of trimmer-arches in fire-places.

He should be able to give sections and elevations to scale, of the following kinds of mason-work, viz.: uncoursed and coursed rubble, block in course and ashlar, with their bond, and the proper dimensions of the stones, as to height, width of beds, and their length, and of the following dressings, viz.: window sills, window and door jambs, plain window and door heads, door steps, string courses, quoins, copings, common cornices, blocking courses; and of the following methods of connecting stones, viz.: by cramps, dowels, joggles, and lead plugs.

He should be able to show how to join timbers by halving, tapping, notching, cogging, scarfing, fishing, and mortise and tenon, as applied to wall plates, roof timbers, floors, ceilings, and partitions.

He should be able to draw, from given dimensions, King and Queen post roofs, and collar beam roofs, also laminated beam curved, and the combination of laminated beam and Howe truss girder used in depots, rinks, and exhibition halls, showing the details of the framing and iron work.

He should be able to draw from given dimensions, single, double, and framed floors, with or without ceilings beneath them; showing modes of supporting, stiffening, and framing

the timbers; trimming round hearths and wells of stairs; also floor coverings of boards or battens, rebated and filleted, ploughed and tongued, and laid close, blind nailed, broken joints, beveled or square butt joints.

He should be able to draw in elevation, from given dimensions, a framed partition with door openings.

He should be able to draw, in elevation, and give vertical and horizontal sections of solid door and window frames.

He should be able to describe, by drawings, b adings of different kinds, dove-tailing, cross-grooving, rebating, plough grooving, champering, rounde l nosings and housings.

He should be able to draw, in elevation, and give vertical and horizontal sections of the following doors, viz.: ledged, ledged and braced, framed and braced, paneled, battened, and the mode of putting them together, positi n of hinges and furniture, as well as to describe, by drawing, the following terms, as applied to paneled doors, viz.: square and flat, raised panel, bead and butt, bead flush, flush moulded, and raised moulded, all on one or both sides.

He should be able to draw, in elevation, and to give vertical and horizontal sections of the following window sashes and frames, viz.: single or double hung sashes, with square, beveled or moulded bars and cased frames; casement sashes hung to solid frames, with method of hanging and securing in each case.

He should be able to draw, in section and elevation, the flashings on chimneys and parapets, the ridge rolls, and hip and valley flashings, gutters, cant boards, connections with leaders, and flat tinning.

He should be able to give an elevation and a section of the slating of a roof laid with different sized slates, on boards or battens, and show the best methods of making such a roof weather and wind-tight.

He should be acquainted with the proper cross-section for cast and wrought iron beams for use in positions of floor beams, or cantilevers, and coupled or tripled by bolting together through separators, for use as girders, and be able to draw such a section in its right proportions from given data.

He should be able to draw, in elevation, from given dimensions, and skeleton diagrams, ordinary iron roofs, up to 40 feet span, showing the sec ions of different parts, and methods of connecting them.

He should also be able to make and explain the following:—

1st. Free-hand sketches explanatory of any details of construction, such as the joints of iron and wooden structures, and other parts requiring illustration on a large scale.

2d. The nature of the stresses to which the different parts of simple structures are subjected, as follows:

In the case of beams, fixed at one end, such as cantilevers, and fixed at both ends or supported at both ends, as in girders, the student should know which side of the beam is in compresison and which in tension.

He should also be acquainted with the best forms for struts, ties, and beams, such as floor joists, exposed to transverse stress.

He should know the difference in the strength of a girder carrying a given load at its centre or uniformly distributed.

In the ordinary kinds of wooden or iron roof trusses, and framed structures of a similar description, he should be able to distinguish members in compression from those in tension.

3d. The nature, application, and characteristic peculiarities of the following materials in ordinary use for building purposes, viz.: Bricks of different kinds in common use, stones, granite, pure lime, hydraulic lime, Portland, Roman, and Rosendale cement, mortars, concretes, grout, asphalt, timber of different kinds in common use, cast and wrought-iron.

4th. Constructive details, as follows:

The ordinary methods of timbering excavations, such as for foundations to walls, or for laying down sewers, the erection of bricklayers' and masons' scaffolding, the construction of travelers, the use of piles in foundations, hoop-iron bond in brickwork, diagonal and herring-bone courses in brickwork, damp proof courses, bond timber in walls and the objections to it.

He should know how bricks are laid in hollow walls, window and door openings with splayed jambs, flues, chimneys, fireplaces, and arches up to about 20 feet span, how mortar joints are finished off, and the thickness usually allotted to them, why bricks and stones ought to be wetted before being laid.

He should be acquainted with the construction of brick ashlar walls, rubble ashlar walls, stone stairs, wooden stairs, both dog-legged and open newell, skylights, fire-proof floors, such as brick or other fire-proof material in arched form, supported, or rolled, or cast-iron girders or beams, c rcular and egg-shaped drains, roofs of iron or wood, the fixing of architraves, linings, skirtings and wainscotings to walls, shutters to windows, lath, plaster, and battening to walls, roof coverings of tiles, slate, and zinc or lead, and slate ridges and hips.

He must possess a complete knowledge of building materials, their application, strength, and how to judge of their quality, and, in the case of iron, of the processes of manufac ure, and the points to be attended to in order to insure sound castings and good rivetings.

He must be able to solve simple problems in the theory of construction, such as in the case of a beam supported at both ends, to ascertain the proportion of the load transmitted to each point of support, and to determine the safe dimensions of iron or wooden beams subjected to dead loads.

In ordinary roof trusses and framed structures of a similar description, he must be able to trace the stresses, brought into action by the load, from the points of application to the points of support, as well as to determine the nature and amount of the stresses on the different members of the truss, and consequently the quantity of material required in each part.

In ordinary walls and retaining walls, he must be able to ascertain the conditions necessary to stability, independent of the strength of the mortar.

But, when others pronounce him incomparable, he will feel, looking at his art from the standpoint he has attained, that he has but just begun to be equipped for his life-work, and that all too soon he will have to rest when all he would desire would be to practice faithfully what he had spent years to learn, and assist others to reach his position with less expenditure of time and trouble.

For those who, I presume, are a majority of my readers, and who have been through the preliminary stages of hand-work in shop or shed; and for those who, still younger, are desirous of entering the offices of their imagination's great lights in the profession, I will add a short, and, I fear, imperfect list, of works—illustrated and scientific—which, well studied, will lead them on to desire further knowledge; and thus set, improving, and on the right path, it rests with themselves if they succeed, or whether they have not mistaken their hopes for evidences of ability.

VALUABLE BOOKS FOR A STUDENT OF ARCHITECTURE.

Mitchell's "Rudimentary Manual of Architecture."
Professor Babcock's "Series upon Elementary Architecture."
Riddell's "Practical Carpenter and Joiner."
Mitchell's "Stepping Stone to Architecture."
Monckton's "Carpenter and Joiner."
Gould's "Carpenter's and Builder's Assistant."
Plummer's "Carpenter's Guide."
Riddell's "Lessons on Hand-Railing."
Monckton's "Stair Builder."
Gould's "American Stair Builder."
Burns' "Notes on Building Construction."

Gwilt's "Encyclopedia of Archi ecture."
R. G. Hatfield's "American House Carpenter."
R. G. Hatfield's "Theory of Transverse Strains."
Parker's "Glossary of Architecture."
De Volson Wood's "Theory and Construction of Bridges and Roofs."
Viollet Le Duc's "Discourses on Architecture."
A. Rosengarten's "Handbook of Architectural Styles."
G. G. Zeriffi's "Manual of Art, with Special Reference to Architecture, etc."
"Ventilation of Buildings." Butler.
Leed's "Treaties on Ventilation."
Saeltzer's "Treatise on Acoustics."
Hallett's "Specifications."
Eveleth's "School-House Architecture."
Gardner's "Common-Sense in Church Building."
Bicknell's "School-House and Church Architecture."
Palliser's "Specifications."
Bicknell's "Builder's Contracts."
Bicknell's "Detail Cottage and Constructive Architecture."
Bicknell's "Cottage and Villa Architecture."
"Modern Architectural Designs and Details."
Powell's "Foundation and Foundation Walls."
Withers' "Church Architecture."
Ruskin's "Seven Lamps of Architecture."
Tuthill's "Practical Lessons in Architectural Drawing."
Vogdes' "Architect's and Builder's Pocket Companion."

The journals of current events of interest containing reports and papers on the scientific and archæological points studied in the profession, and also enumerating the state of work in the United States and Canadas, with cullings from the European press, are:

The American Architect and Building News. Weekly and Monthly. Published in Boston.

Carpentry and Building. Monthly. New York.

Builder and Woodworker. Monthly. New York.

The Manufacturer and Builder. Monthly. New York.

APPENDIX A.

Additional Remarks regarding Draftsman's Outfit.

The drawing-board should be perfectly square at the corners and true on the edges, made from 1¼ inch stuff, and 24 by 36 inches is a good size for most necessary drawings, although it will be found very convenient, in practice, to have a larger one of the dimensions 32 by 48 inches. It should be of well seasoned white pine, and should have *no* clamps across the ends, because even the best seasoned wood will swell and shrink with the change from dry to wet weather, and if the clamps project a hair's breadth beyond the edge, they throw the tongue of the square considerably off the true line. The clamps should be of hard wood about 1 by 1¼ inches, screwed to the board the stiffest way of the section of the clamp, and the screws should be inserted through slots ¼ inch long instead of round holes, so the swelling and shrinking of the boards will be accommodated instead of restrained.

The T squares are instruments for the ruling of long straight lines, and may be used on either edge of the board for horizontal lines, or at the top and bottom for vertical ones. They are made of all kinds of hard wood, some with both edges of the tongue parallel and some that are very long or required to be very stiff have the lower edge oblique, sloping from the stock to the point. The most convenient form is the one in which the tongue is planted on the stock, thus allowing a triangle to move freely when near or over the stock. When the stock or head projects *up* as much as it does *down*, much care must be taken in keeping the hypothenuse of the triangle on the *right*, or it will be impossible to make vertical lines close to the head.

Another useful form of square is the bevel in which the head or stock is movable on the end of the tongue, on a pivot which has a large milled head nut, working on a screw, so adjusted that the head can be made to take any angle to the tongue, and so enabling, by the usual manipulation of the instrument, parallel oblique lines, such as cornices on gables, pediments, stairs, and rake wainscoting to be drawn with greater ease and quickness than if the usual form of square were used, and a triangle. A combination of these two squares has the head split so that one side can be used as a permanent square, and the other shifted so as to form a bevel.

The triangles are of various sizes, and in practice, two sets are desirable, one a small one, preferably of black rubber, and thick rather than thin, as they will not be so likely to slip under the edge of the tongue of the square. These are used for drawing small drawings, such as scale plans, elevations, etc., where a line not more than four inches long is likely to be

drawn. But for larger drawings, a set of triangles, the sides of which are 12 and 14 inches long, are indispensable. For full size details, even larger ones are convenient.

The thumb tacks are made like common tacks, with heads varying from the size of an old fashioned three cent piece to that of a dime. The points are of steel, round, and screwed into the head, in the best kinds, and simply riveted in, in the commoner kinds. The best have German silver heads, and the common ones brass. They are used to fasten temporary drawing sheets to the board, and are pressed in with the thumb, and can be easily withdrawn by running under the broad head a thin knife-blade. Finger-nails are good for the purpose, while they last, which is usually not long. Pencils can be obtained of various makes, the best being of foreign make, called the Siberian, made by A. W. Faber. The 3H is the most useful, the harder grades only coming useful in extra fine work, on special paper.

Rubber can be obtained also of various shapes, sizes, styles and qualities, but the best is A. W. Faber's Artist's Gum, large cakes. This quality works best on all grades of paper, and is neither too hard nor too soft for all kinds of use.

An ink slab is to grind the India ink on, and is made of either earthenware, slate, or ground glass, and the best form is a circular shape, dishing toward the centre, where there is a deep well. There is a cover, and ink will keep in usable condition in it from three to four days.

The earthenware color saucers come in a nest, that is to say, so fitted together that six of them make one set, with lips and ledges so that they sit securely in one pile when not in use. Other saucers are all open, and have six or nine inclined divisions for different colored water-colors.

The camel's hair brushes most used are of three or four sizes, from the smallest, about as large as the lead of a lead pencil, up to a flat brush in a handle the size of an ordinary pen-holder. These are used to lay on the colors red, for brick, yellow for wood, blue for stone and iron, brown for black-walnut and brown-stone, etc., etc., and after use should always be rinsed clean, and well dried.

The water-colors, red, yellow, blue and brown, may be supplemented by as many more, if desired, but the red should be carmine, the yellow, ochre, the blue, French blue, and the brown, Vandyke brown. Care must be taken to wipe the end of the cake dry after rubbing the color, or the dampness thus left will be apt to permeate the cake and cause it to crumble.

The India ink of the best kind will give the most satisfac ory results, but there is a choice between an ink that dries glossy, and one that dries a dead black. The latter is the most preferred, but is hard to secure. The same care in keeping dry must be exercised, or the stick will crumble to unusable fragments.

APPENDIX B.

THE PROPORTION OF ROOMS

is a question that has often been discussed, but, as far as I am aware, has never been definitely settled, and probably never will be. I think, however, that the relative proportions of a large room would be quite inappropriate for a small one. For instance, the double square, which might do for a room 20 feet by 40 feet, would, on the other hand, be very inconvenient, if made 10 feet by 20 feet.

Rooms 20 feet by 40 feet are handsome and useful, but rooms formed to correspond with the lesser figures (10 feet by 20 feet) are not of a useful shape. It is therefore necessary to devise a kind of sliding scale, giving more squareness to small rooms and more length to large ones. As to height, we leave that an open question; some would make them a greater height than others, according to the uses to which they are to be put, aside from the question of strict proportion on the one hand, and of acoustic perfection on the other. The proportion of height should generally range from two-thirds to three-fourths of the width, and must depend on whether the apartment is lighted from the end, or side, or ceiling. Most frequently it would be from one end and one side.

The sliding scale proposed is as follows:

LENGTH.	BREADTH.	
50 feet	30 feet.	
40 "	25 "	
36 "	23 "	
30 "	20 "	
25 "	17 "	6 inches.
20 "	15 "	
18 "	14 "	
15 "	12 "	6 inches.
12 "	11 "	
10 "	10 "	

The principle is very simple, namely: that, starting with a room 30 feet by 20 feet, we add or subtract 2 feet from the length for every 1 foot of the breadth. Thus, if a room is intended to be 22 feet long (that is, 8 feet less than the 30 feet), then the breadth should be 4 feet less than the 20 feet, or 16 feet. Any one can carry the rule in his memory without much difficulty, simply calling to mind 30 by 20 and making an allowance of 2 feet of length for every 1 foot of breadth, whether increasing or diminishing in size. The scale above given is of practical dimensions for dining-rooms, drawing-rooms, very nearly of billiard-rooms, and as it descends, of other apartments. Of course, no one would be so absurd as to advocate every room in a house being strictly to such a scale, but it affords hints of proportions which would generally be useful and appropriate.

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